September 24, 2020

VIA IBFS

Marlene H. Dortch, Secretary
Federal Communications Commission
445 12th Street S.W.
Washington, D.C. 20554

Re: *Ex Parte* Communication, File No. SAT-MOD-20200417-00037

Dear Ms. Dortch:

Kuiper Systems LLC, a wholly owned subsidiary of Amazon.com Services LLC (collectively, "Amazon"), files this letter and the enclosed presentation shown to the Federal Communications Commission on September 22, 2020. A list of meeting participants is attached.

Amazon reiterated its concerns regarding the above-referenced modification application (the "Third Modification") filed by Space Exploration Holdings, LLC ("SpaceX"). Amazon emphasized that SpaceX must resolve the space safety issues created by the Third Modification. Assuming SpaceX can resolve such issues, the significantly increased interference environment introduced by the Third Modification requires the Commission to include the entire redesigned SpaceX system as part of the NGSO FSS Processing Round initiated on March 24, 2020. Doing so would be consistent with Commission precedent and would protect the public interest, encourage coordination, and promote competition.

Please contact me with any questions.

Respectfully submitted,

/s/ Mariah Dodson Shuman

Mariah Dodson Shuman
Corporate Counsel
Kuiper Systems LLC,
an Amazon subsidiary

Attachment

Commission Attendees	Amazon Attendees
Karl Kensinger	Julie Zoller
Kerry Murray	Kalpak Gude
Jay Whaley	David Kaufman
Paul Blais	Darren Achord
Anthony Asongwed	Mariah Dodson Shuman
Jeannette Spriggs	
Joe Hill	
Trang Nguyen	

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OVERVIEW OF CONCERNS WITH SPACEX'S THIRD MODIFICATION

Safety

- The record in this proceeding establishes that there are significant, unresolved space safety issues created by the Third Modification.
- SpaceX should acknowledge the proposed space safety solutions and commit to not overlapping its redesigned system with the licensed Kuiper System orbits.

Interference

- The significant impact of Third Modification on the licensed Kuiper System must be considered.
- Consistent with precedent, the FCC should include the entire redesigned SpaceX system in the 2020 Processing Round to protect the public interest.

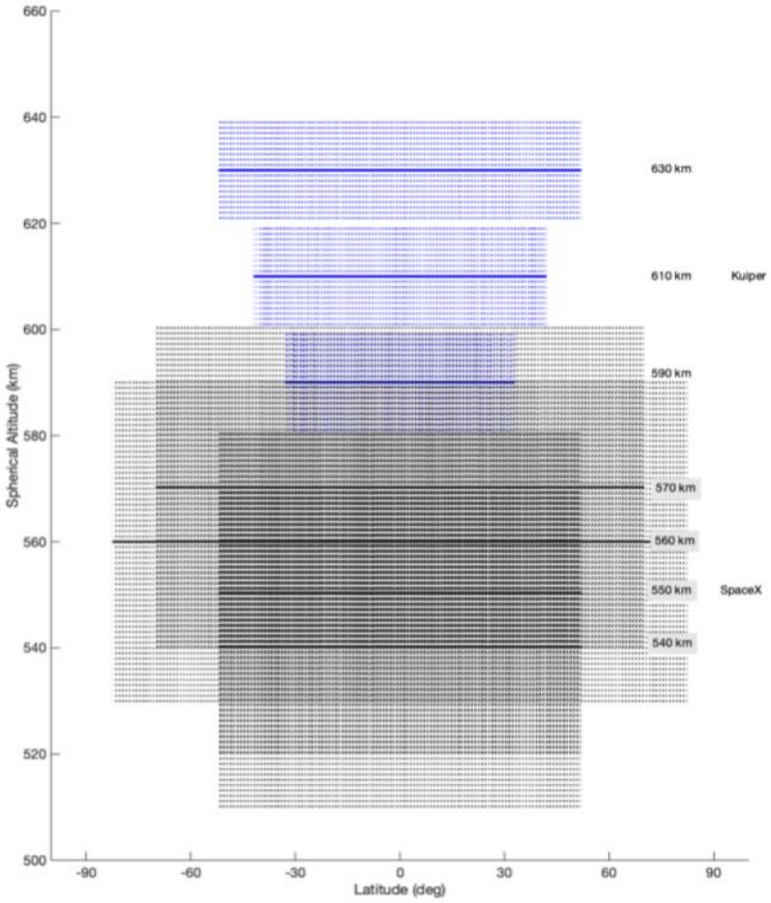
SPACEX SHOULD RESOLVE SPACE SAFETY CONCERNS

Transparency

- SpaceX states that “most” of its satellites “will operate within much less than 30 kilometers of their nominal altitude most of the time”.
- SpaceX must provide details and commitments about its orbital operations.

Solutions

- SpaceX has not adequately addressed the risk proposed by its Third Modification, despite Amazon’s proposed solutions to preclude overlap with the licensed Kuiper System:
  - SpaceX could control orbital tolerance, or
  - SpaceX could limit nominal altitude to no higher than 550 km.



THE KUIPER SYSTEM MUST BE INCLUDED IN THE ANALYSIS OF THE THIRD MODIFICATION'S IMPACTS

Precedent

- SpaceX claims that "because [Amazon] was not considered in the same processing round as SpaceX, Amazon is not entitled to the same interference considerations as are first-round licensees." – *SpaceX Consolidated Opposition and Response*
- SpaceX's claim conflicts with FCC precedent: "… we will evaluate Teledesic's proposed modifications with respect to all pending NGSO FSS applications, and with licensed systems operating in shared frequency bands." – *Teledesic*
- The Kuiper System must be given consideration with respect to the change in interference.

Impact to the Kuiper System

- The Kuiper System license contains a condition to complete coordination with or make a showing that it will not cause harmful interference to any operational system authorized in the 2016 Processing Round. SpaceX seeks to move the goal posts for this condition.
- If included in the 2016 Processing Round, the Third Modification makes coexistence more difficult and would increase the burden to the Kuiper System

SPACEX'S THIRD MODIFICATION BELONGS IN 2020 PROCESSING ROUND

"If the proposed modification does not present any significant interference problems and is otherwise consistent with Commission policies it is generally granted"… " In contrast if the modification application were to present ***significant interference problems****, we would treat the modification as a newly filed application and would consider the modification application in a subsequent satellite processing round." – Teledesic*

Factors the Commission considers when evaluating a modification:		**Elements of Third Modification that create significant interference when evaluated against such factors:**
"A system's orbital configuration can impact its ability to share with other systems and services by affecting the number of active satellites "visible" at a particular location. The magnitude of sharing difficulty increases with an increase in the number of active visible satellites in the modified system." – *Teledesic*		SpaceX has doubled the number of active satellites operating with each of its Ka-band gateway earth stations. The modification also creates new geometries in which interference will occur.
The frequency and duration of in-line events are meaningful factors in assessing interference impacts. – *SpaceX First Modification Reconsideration*		SpaceX significantly increases the number and duration of in-line events with other NGSO systems, due to its reduced elevation angles, lower altitudes, and doubling the number of active satellites.
The Commission "must examine not only the potential for increased interference to other NGSO FSS systems as a result of SpaceX's modified operations, but also whether SpaceX's own system may become more susceptible to interference from other NGSO FSS systems, which would change the operating environment." – *SpaceX First Modification Authorization*		The modification increases SpaceX's susceptibility to interference. SpaceX has not agreed to accept more interference from the Kuiper System or other 2020 Processing Round systems.

SPACEX'S THIRD MODIFICATION REPRESENTS AN EXPANSIVE SYSTEM REDESIGN

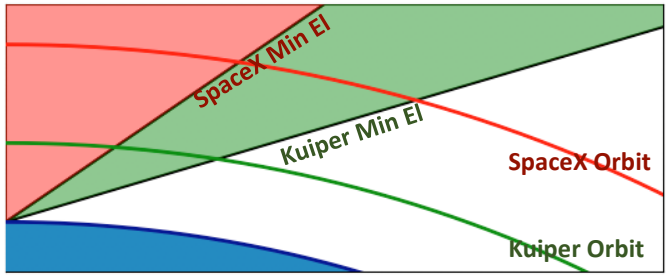
SpaceX's proposed changes to its operations, satellite design, and orbital configuration are not a benign reconfiguration of its authorized system; this redesign constitutes a broad expansion of the operational envelope of the SpaceX system. This expansion would have a much more significant effect on other NGSO FSS operators than did the first two modifications.

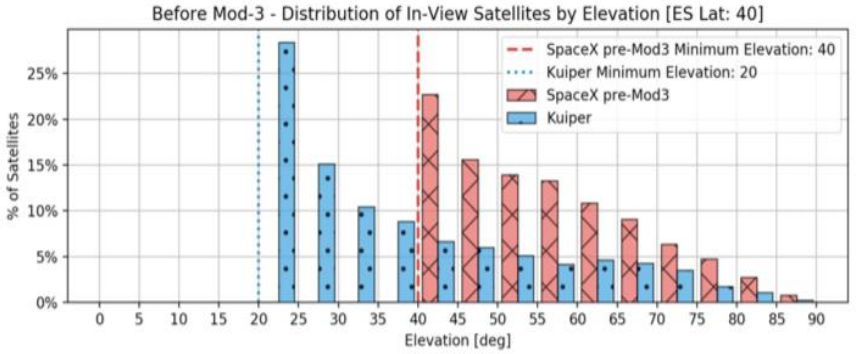
First Modification	Second Modification	Third Modification
Lowered altitude of 1,584 satellites from 1,150 km to 550 km, and reduced size of constellation by 0.36%.	Redistributed the satellites in the 550 km orbital shell among different planes.	Reduced minimum elevation angle by 15 degrees; doubled number of active satellites per earth station; increased size of Ka-band beam footprints; reduced altitude of remaining satellites; reduced size of constellation by 0.02%.
Impact: *Change in orbital configuration affected peak I/N levels, but little change in number of in-line events or statistical interference levels.*	***Impact:*** *Little change in the number of in-line events or statistical interference levels.*	***Impact + comparison:*** *Changes to operations, spacecraft design, and orbital configuration are a broad expansion of operational envelope, resulting in more in-line events, with a much more significant effect on other NGSO FSS operators than the first two modifications.*

SPACEX'S LOWER ELEVATION ANGLES CREATE MORE IN-LINE EVENTS WITH THE KUIPER SYSTEM

Majority of Kuiper satellites operate below SpaceX's currently authorized minimum elevation angle.

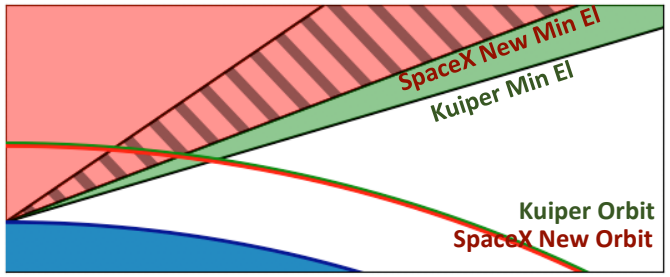
SpaceX Current Authorization. Minimum Elevation: 40 degrees

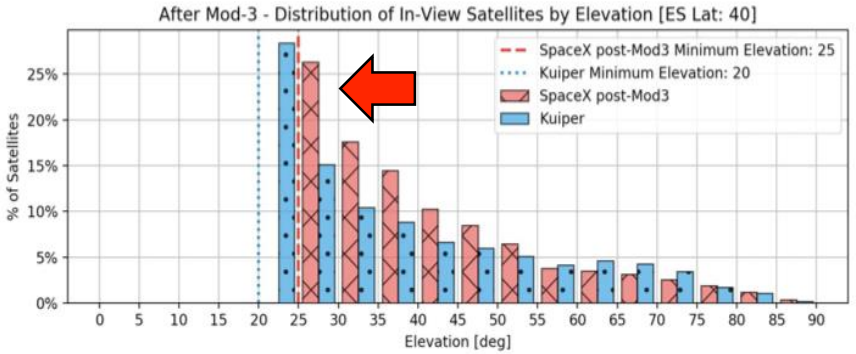




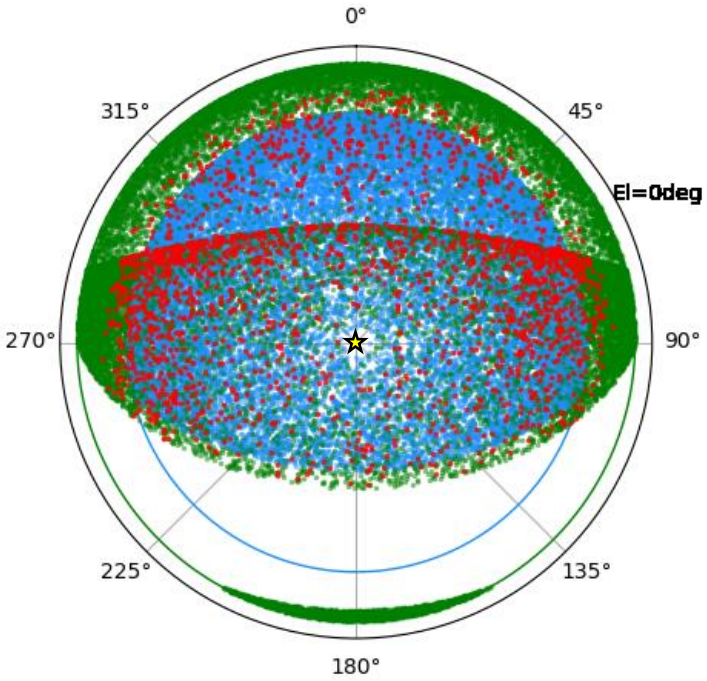
SpaceX's modification would eliminate the natural deconfliction between Kuiper and SpaceX's currently authorized system.

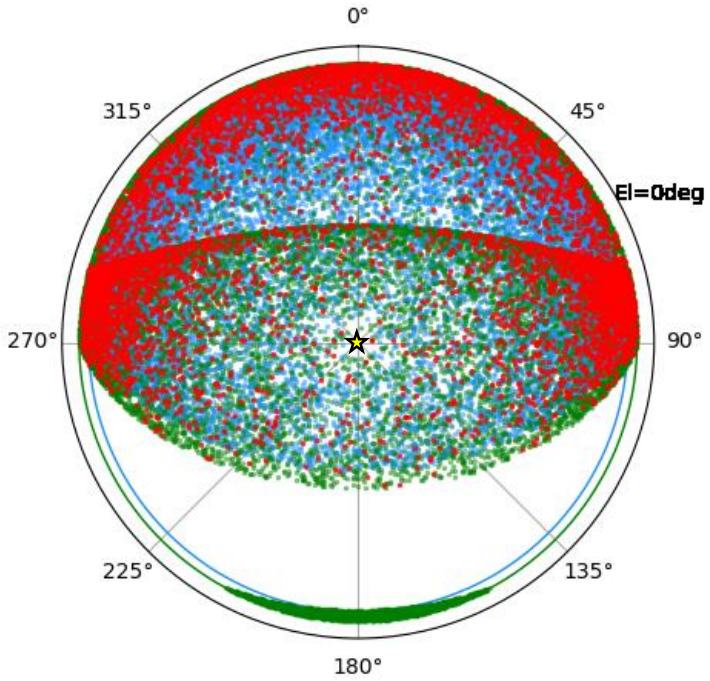
SpaceX Modification. Minimum Elevation: 25 degrees

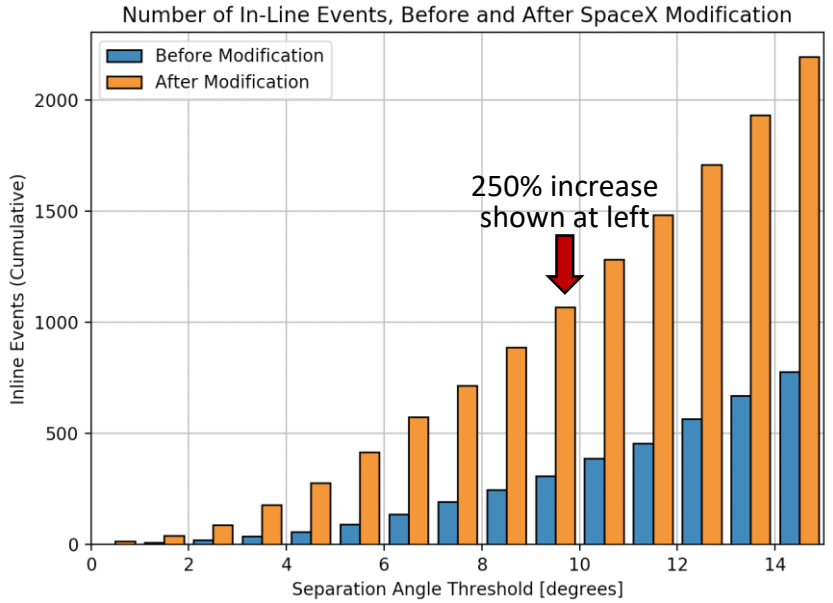




MORE IN-LINE EVENTS WORSENS THE INTERFERENCE ENVIRONMENT AND BURDENS THE KUIPER SYSTEM





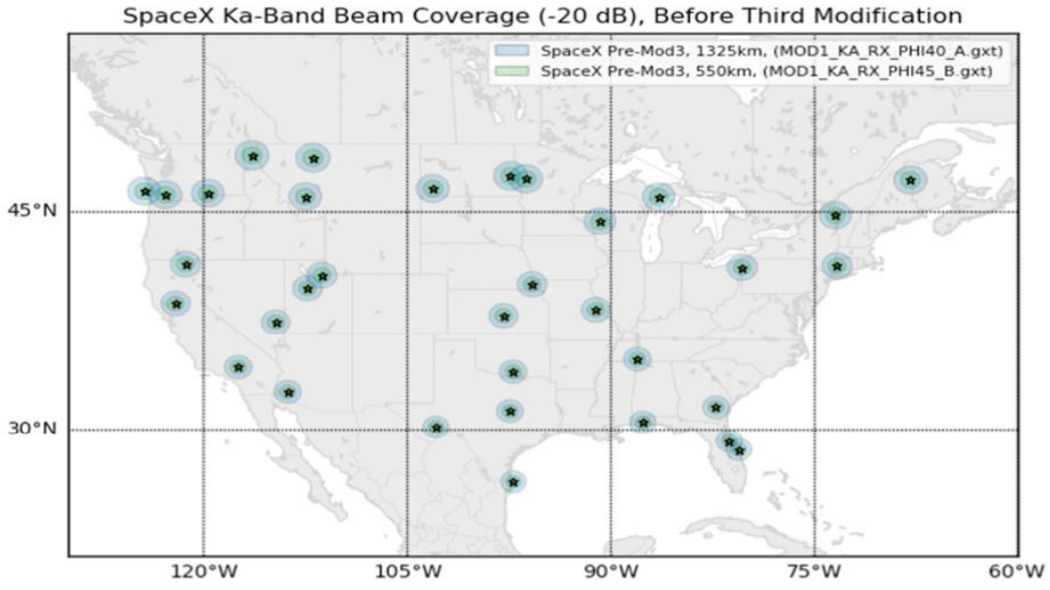


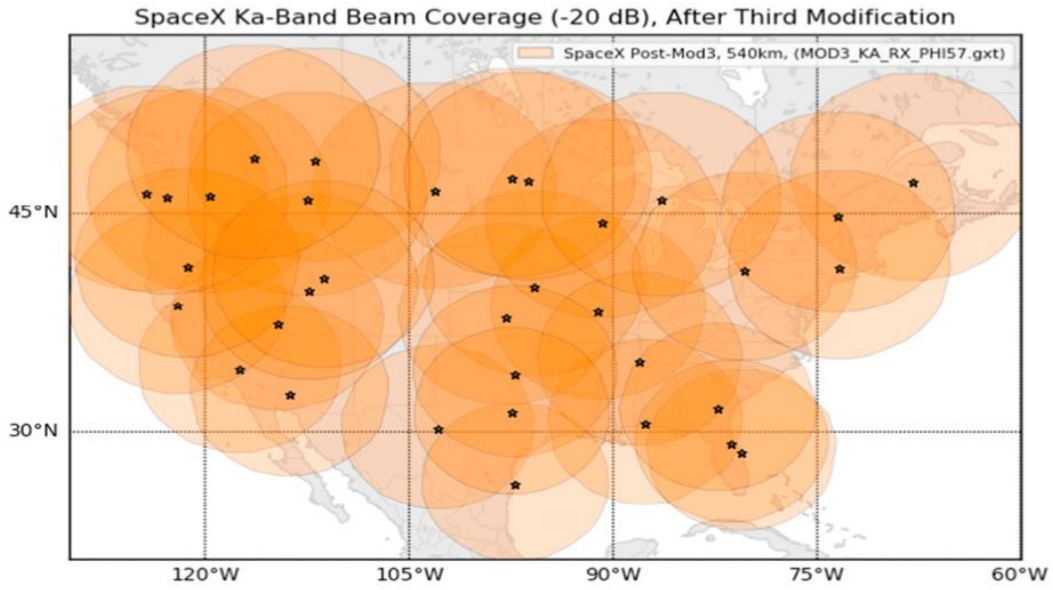
- ☆ Earth Station located at 40N
- ● SpaceX Satellite
- ● Unaffected Kuiper Satellite
- ● Affected Kuiper Satellite (i.e. Inside the interference cone of an active SpaceX satellite)

By reducing its minimum elevation to 25°, doubling the number of "active" satellites, and reducing its satellites' altitudes, the number of in-line interference events is increased by 250% in this case.

The increase in in-line events causes a significant interference problem and reduces the number of available Kuiper satellites.

SPACEX'S EXPANDED BEAM FOOTPRINTS IMPACT KUIPER





If earth stations from two networks are sufficiently separated, the geographical separation can offset the interference between the two systems. This is an effective mitigation technique in both the uplink and downlink directions.

SpaceX's modified contours would cover the entire CONUS, which inhibits earth station separation as a tool for NGSO/NGSO interference mitigation, worsening the interference environment and reducing NGSO FSS spectral efficiency.

SPACEX HAS NOT ADDRESSED SIGNIFICANT INTERFERENCE CONCERNS ON THE RECORD

SpaceX Claim from 9/14/2020 Ex Parte	Actual Impact and Unresolved Interference Concern
It is a “Partial constellation modification”	This is not a “partial constellation modification” -- ALL SpaceX satellites are being modified.
“min elevation: 40deg → 25deg for added system flexibility”	The reduced earth station elevation angle increases the potential for interference with Kuiper and other NGSO systems and causes a substantial increase in in-line events.
“PFD is the same or reduced” “G/T on satellite is reduced”	SpaceX’s Ka-band PFD and G/T are increased over large land areas due to the antenna re-design as evidenced in its new beam contours. G/T also increased at max scan angle.
“SpaceX agreed to accept Delta susceptibility increase”	SpaceX has not agreed to accept additional interference from Kuiper or other 2020 processing round systems, and SpaceX’s method for computing this delta is inadequate and SpaceX’s proposal does not mitigate the impact to other NGSO systems.
“Nco = 4 → Nco = 8, PFD is reduced by 3 dB to account for this”	SpaceX’s increased Nco is a significant component of the substantial increase in in-line events that results from the Modification. SpaceX’s Nco affects all four NGSO/NGSO interference scenarios, but SpaceX’s PFD only affects one of four interference scenarios.
“I/N does not change significantly"	Multiple operators have demonstrated significant increases in I/N to and from SpaceX.
“no impact on geometric in-line events at a given location”	SpaceX’s modification causes substantial increase in the number and duration of in-line events with Kuiper and other NGSO systems, as Amazon and other operators have shown.
“the number of gateway sites is cut in half”	SpaceX’s proposed reduction in gateway sites is negated by its increased beam size, which reduces the benefits of earth station separation

CONCLUSION

- SpaceX must provide details and commitments about its orbital operations to resolve the space safety risks generated by the Third Modification.
- The Kuiper System must be included in the analysis of the Third Modification's impacts.
- The Third Modification presents significant interference problems and does not meet the *Teledesic* standard, and thus should be included in the 2020 Processing Round.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